

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU99/00498</p> <p>(22) International Filing Date: 18 June 1999 (18.06.99)</p> <p>(30) Priority Data: PP 4173 18 June 1998 (18.06.98) AU</p> <p>(71) Applicant (for all designated States except US): AMCOR PACKAGING (AUSTRALIA) PTY. LTD. [AU/AU]; 971-973 Burke Road, Camberwell, VIC 3124 (AU).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): CAREW, David, Lee [AU/AU]; 5 Currunghi Court, St Albans, VIC 3021 (AU).</p> <p>(74) Agent: GRIFFITH HACK; 509 St Kilda Road, Melbourne, VIC 3004 (AU).</p>		<p>(81) Designated States: AU, CA, NZ, US.</p> <p><b>Published</b> With international search report.</p>
<p>(54) Title: METHOD AND APPARATUS FOR COATING BOTTLES</p> <div data-bbox="300 1142 1398 1570"> </div> <p>(57) Abstract</p> <p>A method and apparatus for coating bottles made from a plastics material with a coating formulation is disclosed. The method includes the steps of: a) positioning bottles on support members which engage the bottles; b) successively moving each bottle along a path (7) to a coating station (13); c) whilst each bottle is at the coating station (13), rotating each bottle about its longitudinal axis and simultaneously spray coating the exposed outer surface of the bottle; and d) transferring the coated bottles to a curing oven (19) and curing the coatings in the oven.</p> <p style="text-align: right;"><b>BEST AVAILABLE COPY</b></p>		

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METHOD AND APPARATUS FOR COATING BOTTLES

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The present invention relates to a method and to  
an apparatus for coating bottles with a coating  
10 formulation.

In particular, the present invention relates to a  
method and to an apparatus for coating PET bottles with a  
formulation that forms a coating that acts as a CO<sub>2</sub>/O<sub>2</sub> gas  
15 barrier.

It is known to coat PET bottles with gas barrier  
coating formulations by:

- 20 (a) positioning bottles on an array of  
downwardly extending collets that retain the  
bottles vertically; and
- (b) moving the array of collets along a  
25 continuous path that transports the bottles:
- (i) past a series of sprays in a spray  
chamber which spray the external  
surface of the bottles and forms  
30 coatings thereon;
- (ii) through a curing oven and curing the  
coatings on the bottles; and
- 35 (iii) to an out-feed station that detaches  
the cured coated bottles from the  
collets.

There are a number of significant disadvantages with the known method and apparatus.

5           By way of example, there is substantial wastage, typically 35%, of the coating formulation in the spray chamber. This is a particularly serious issue in view of the high cost of gas barrier coating formulations.

10           The substantial wastage of the coating formulation also makes it necessary to carry out significant on-going maintenance of the spray chamber, the associated air ventilation system, and the collets to remove build-up of the coating formulation.

15           Furthermore, the use of collets to transport bottles through the spray chamber and the oven and the arrangement of collets in a continuous path makes it necessary to use a relatively long curing oven which  
20 occupies a relatively substantial space.

          An object of the present invention is to provide an alternative method and apparatus for coating bottles with a coating formulation.

25           According to the present invention, there is provided a method of coating bottles made from a plastics material with a coating formulation, which method includes the steps of:

- 30           (a) positioning bottles on support members which engage the bottles;
- (b) successively moving each bottle to a coating  
35 station;
- (c) whilst each bottle is at the coating

station, rotating each bottle about its longitudinal axis and simultaneously spray coating the exposed outside surface of the bottle; and

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- (d) transferring the coated bottles to a curing oven and curing the coatings in the oven.

The coating formulation may be any suitable formulation.

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Preferably, the coating formulation forms a coating that prevents/minimises gas transfer through the plastics material.

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Preferably the plastics material is PET.

Preferably the method includes positioning bottles on support members at an in-feed station, moving the support members and the bottles thereon from the in-feed station to the coating station and spray coating exposed surfaces of the bottles at the coating station, and moving the support members and coated bottles thereon from the coating station to an out-feed station and detaching the coated bottles from the support members at that station, and moving the support members from the out-feed station to the in-feed station.

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Preferably the support members engage the open ends of the bottles.

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Preferably the method includes spray coating exposed surfaces of each bottle at the coating station in two steps, wherein the first step includes spray coating exposed surfaces of the neck and base and the second step includes spray coating exposed surfaces of the body of the bottle.

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5 Preferably the method includes stopping the movement of the support members along the path when a support member carrying a bottle reaches the coating station.

10 More preferably the method includes moving the bottles along the path in indexed steps whereby when a support member carrying a bottle stops at the coating station, simultaneously:

- (i) a support member carrying a coated bottle stops at the out-feed station; and
- 15 (ii) a support member from which a coated bottle has been detached stops at the in-feed station.

20 Preferably the method includes transferring the coated bottles from the support members to a separate support assembly and moving the support assembly into the curing oven.

25 According to the present invention there is provided an apparatus for spray coating bottles made from a plastics material with a coating formulation, which apparatus includes:

- 30 (a) a coating station which includes spray coating means for spraying the coating formulation onto exposed surfaces of bottles, and
- 35 (b) an assembly for supporting a plurality of bottles and moving the bottles in a path from an in-feed station to the coating station and from the coating station to an

5 out-feed station, and the assembly includes a plurality of support members, with each support member being adapted to hold a bottle and to rotate the bottle about its longitudinal axis when the bottle is at the coating station to facilitate spray coating of the exposed surface of the bottle.

10 Preferably the coating station includes:

- (i) a spray coating assembly for spray coating the neck and base regions of the bottle; and
- 15 (ii) a separate spray coating assembly for spray coating the body of the bottle that is downstream of the neck/base spray coating assembly in the direction of movement of bottles along the path from the in-feed to the out-feed stations.

20 Preferably the assembly for supporting and moving the bottles includes a drive means for moving the bottles along the path from the in-feed to the out-feed stations.

25 Preferably the drive means is adapted to stop the movement of bottles along the path when a bottle reaches the coating station.

30 More preferably the drive means is adapted to stop the movement of bottles along the path when a bottle reaches the neck/base spray coating assembly and when a bottle reaches the body spray coating assembly.

35 Preferably the drive means is adapted to move the support members and bottles carried thereon in a series of indexed steps whereby in use when one of the support members stops at the coating station, simultaneously:

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- (i) a support member carrying a coated bottle stops at the out-feed station; and
- 5 (ii) a support member from which a coated bottle has been detached stops at the in-feed station.

10 Preferably the assembly for supporting and moving the bottles includes a turret that is rotatable about a vertical axis.

15 Preferably the support members are mounted to the turret so as to support bottles to move in a circular path.

20 Preferably the support members are adapted to support bottles horizontally.

25 More preferably each support member includes a spindle that is rotatable about its axis and a collet for retaining a bottle to the support member in a horizontal position.

30 Preferably the apparatus further includes a curing oven for curing coated bottles.

35 Preferably the apparatus further includes transfer means for detaching coated bottles from the support members at the out-feed station and for transferring the coated bottles to the curing oven.

40 Preferably the transfer means includes a support assembly for supporting the coated bottles horizontally.

45 Preferably the support assembly includes a plurality of cradles for the coated bottles.



The present invention is described further by way of example with reference to the accompanying drawings of which:

5           Figure 1 is a top plan view which shows the general layout of the components of a preferred embodiment of an apparatus in accordance with the present invention;

10           Figure 2 is an end elevation of the neck/base spray assembly and the body spray assembly which form the coating station of the apparatus, as viewed in the direction of the arrow A in Figure 1;

15           Figure 3 is a side elevation of the neck/base spray assembly;

20           Figure 4 is an end elevation of the neck/base spray assembly as viewed in the direction of the arrow B in Figure 3;

            Figure 5 is a side elevation of the body spray assembly; and

25           Figure 6 is an end elevation of the body spray assembly as viewed in the direction of the arrow C in Figure 5.

30           With reference to Figure 1, in general layout terms, the preferred embodiment of the apparatus of the present invention includes an unscrambler assembly 5 which receives bottles from a hopper 3 and delivers the bottles onto a feed conveyer 7 so that the bottles move in nose to tail relationship along the feed conveyer to an in-feed station 9 of an assembly, generally identified by the  
35           numeral 11. As is described in more detail hereinafter, the bottles are moved in a circular path from the in-feed station 9 to a coating station, generally identified by the

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numeral 13, and are spray coated at that station, and the coated bottles are moved from the coating station 13 to an out-feed station 15. At the out-feed station 15 the coated bottles are detached from the assembly and are transferred  
5 via a transfer conveyer 17 through a curing oven 19 and are cured in that oven.

The assembly 11 includes a turret 21 that is arranged to rotate about a vertical axis.

10

The assembly 11 further includes a plurality of support members (not shown) that are mounted to the turret in a circular array and are arranged to support bottles horizontally as the turret 21 rotates and moves the bottles  
15 in a circular path from the in-feed station 9 to the coating station 13 and then to the out-feed station 15.

The apparatus includes a cartridge loading assembly at the in-feed station which receives bottles from  
20 the feed conveyor 7 and locates bottles on the support members at the in-feed station 9.

Each support member includes a spindle (not shown) that can rotate about its axis and a collet (not  
25 shown) which is adapted to retain the necks of bottles by a friction fit.

A turret drive (not shown) rotates the turret 21 in a series of indexed steps which positions each spindle  
30 successively at the coating station 13.

With the above-described arrangement, when a support member carrying a bottle is at the coating station 13, a spindle drive rotates the spindle and the bottle  
35 supported by the spindle while the bottle is being sprayed by the coating formulation. This arrangement makes it possible to use a relatively confined spray pattern that

minimises coating formulation wastage. This arrangement also makes it possible to use fixed sprays at the coating station 13, while ensuring substantially complete coverage of exposed surfaces of bottles with the coating formulation.

The coating formulation may be any suitable formulation. In addition, the spray coating technology may be any suitable technology including, by way of example, electrostatic spray coating technology.

The spindle drives are also arranged to rotate the spindles and bottles thereon for a short distance after the spindles are moved from the coating station 13.

With reference to Figures 2 to 6, the coating station 13 is arranged to coat each bottle in two separate steps. In the first step exposed surfaces of the neck and base of a bottle are spray coated with suitable coating formulation and in the second step exposed surfaces of the body of the bottle are spray coated with the formulation.

The coating station 13 includes a neck/base spray coating assembly, generally identified by the numeral 27, and a body coating assembly, generally identified by the numeral 29. The body coating assembly 29 is downstream of the neck/base coating assembly 27 in the direction of movement of the bottles along the circular path from the in-feed station 9 to the out-feed station 23. The indexed movement of the turret drive is such that bottles are stationary (in the sense of movement along the circular path) at each assembly 27, 29 and the spindle drives of the support members rotate the bottles around their longitudinal axes while bottles are being sprayed at each assembly 27, 29.

With reference to Figures 3 and 4, the neck/base

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coating assembly 27 includes an upright post 35, an arm 33 extending from an upper end of the post 35, and a spray head 37 with a spray nozzle 31 pivotally mounted to the arm 33. The arrangement is such that the nozzle 31 is positioned immediately above the neck of a bottle 57 located at the neck/base coating assembly.

Similarly, the neck/base coating assembly 27 includes an upright post 9, an arm 41 extending from an upper end of the post 39, and a spray head 43 with a spray nozzle 45 pivotally mounted to the arm 41. The arrangement is such that the nozzle 45 is positioned immediately adjacent the base of a bottle 57 located at the neck/base coating assembly.

With reference to Figures 5 and 6, the body coating assembly 29 includes an upright post 47, a relatively short arm 49 extending from an upper end of the post 47, and a spray head 51 with a spray nozzle 53 pivotally mounted to the arm 49. The arrangement is such that the nozzle 53 is positioned immediately above the body of a bottle 57 located at the body coating assembly.

The spacing between the coating station 13 and the out-feed station 15 is selected to enable sufficient time for evaporation of solvent of the coating formulation and for an increase in viscosity of the coating component of the coating formulation to facilitate transfer of coated bottles to the curing oven 19 with minimal loss of coating.

At the out-feed station 15 the coated bottles are detached from the support members and are transferred onto a support assembly which includes a series of cradles 23 that support the coated bottles on their sides on the transfer conveyor 17. The coated bottles are detached from the support members by means of a vacuum suction cup assembly.

The curing oven 19 is constructed so that the coated bottles move in a serpentine path, with a series of vertical sections interconnected by horizontal sections, between an inlet at one end of the oven and an outlet at the other end. As a consequence, the oven is a relatively compact construction.

The bottles in the curing oven 19 are cured at a temperature of at least 60°C for a residence time of 10-15 minutes.

The applicant has found in pilot plant work operating the above-described apparatus in accordance with the method of the present invention that wastage of the coating formulation was less than 20%, more typically less than 15%. This is a significant improvement over that achieved with the known method and apparatus described above.

20

Many modifications may be made to the preferred embodiment of the present invention described above without departing from the spirit and scope of the present invention.

## CLAIMS:

1. A method of coating bottles made from a plastics material with a coating formulation, which method includes the steps of:

- (a) positioning bottles on support members which engage the bottles;
- (b) successively moving each bottle along a path to a coating station;
- (c) whilst each bottle is at the coating station, rotating each bottle about its longitudinal axis and simultaneously spray coating the exposed outside surface of the bottle; and
- (d) transferring the coated bottles to a curing oven and curing the coatings in the oven.

2. The method defined in claim 1 includes positioning bottles on support members at an in-feed station, moving the support members and the bottles thereon from the in-feed station to the coating station and spray coating exposed surfaces of the bottles at the coating station, and moving the support members and coated bottles thereon from the coating station to an out-feed station and detaching the coated bottles from the support members at that station, and moving the support members from the out-feed station to the in-feed station.

3. The method defined in claim 1 or claim 2 includes spray coating exposed surfaces of each bottle at the coating station in two steps, wherein the first step includes spray coating exposed surfaces of the neck and base and the second step includes spray coating exposed

surfaces of the body of the bottle.

4. The method defined in any one of the preceding claims includes stopping the movement of the support members along the path when a support member carrying a bottle reaches the coating station.

5. The method defined in claim 4 includes moving the bottles along the path in indexed steps whereby when a support member carrying a bottle stops at the coating station, simultaneously:

(i) a support member carrying a coated bottle stops at the out-feed station; and

(ii) a support member from which a coated bottle has been detached stops at the in-feed station.

6. The method defined in any one of the preceding claims includes transferring the coated bottles from the support members to a separate support assembly and moving the support assembly into the curing oven.

7. An apparatus for spray coating bottles made from a plastics material with a coating formulation, which apparatus includes:

(a) a coating station which includes spray coating means for spraying the coating formulation onto exposed surfaces of bottles, and

(b) an assembly for supporting a plurality of bottles and moving the bottles in a path from an in-feed station to the coating station and from the coating station to an

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5 out-feed station, and the assembly includes a plurality of support members, with each support member being adapted to hold a bottle and to rotate the bottle about its longitudinal axis when the bottle is at the coating station to facilitate spray coating of the exposed surface of the bottle.

10 8. The apparatus defined in claim 7 wherein the coating station includes:

- (i) a spray coating assembly for spray coating the neck and base regions of the bottle; and
  - 15 (ii) a separate spray coating assembly for spray coating the body of the bottle that is downstream of the neck/base spray coating assembly in the direction of movement of bottles along the path from the in-feed to the out-feed stations.
- 20

9. The apparatus defined in claim 7 or claim 8 wherein the assembly for supporting and moving the bottles includes a drive means for moving the bottles along the path from the in-feed to the out-feed stations.

25

10. The apparatus defined in claim 9 wherein the drive means is adapted to stop the movement of the bottles along the path when a bottle reaches the coating station.

30

11. The apparatus defined in claim 10 wherein the drive means is adapted to move the support members and bottles carried thereon in a series of indexed steps whereby in use when one of the support members stops at the coating station, simultaneously, a support member carrying a coated bottle stops at the out-feed station and a support member from which a coated bottle has been detached stops

35



at the in-feed station.

12. The apparatus defined in any one of claims 7  
to 11 wherein the assembly for supporting and moving the  
5 bottles includes a turret that is rotatable about a  
vertical axis.

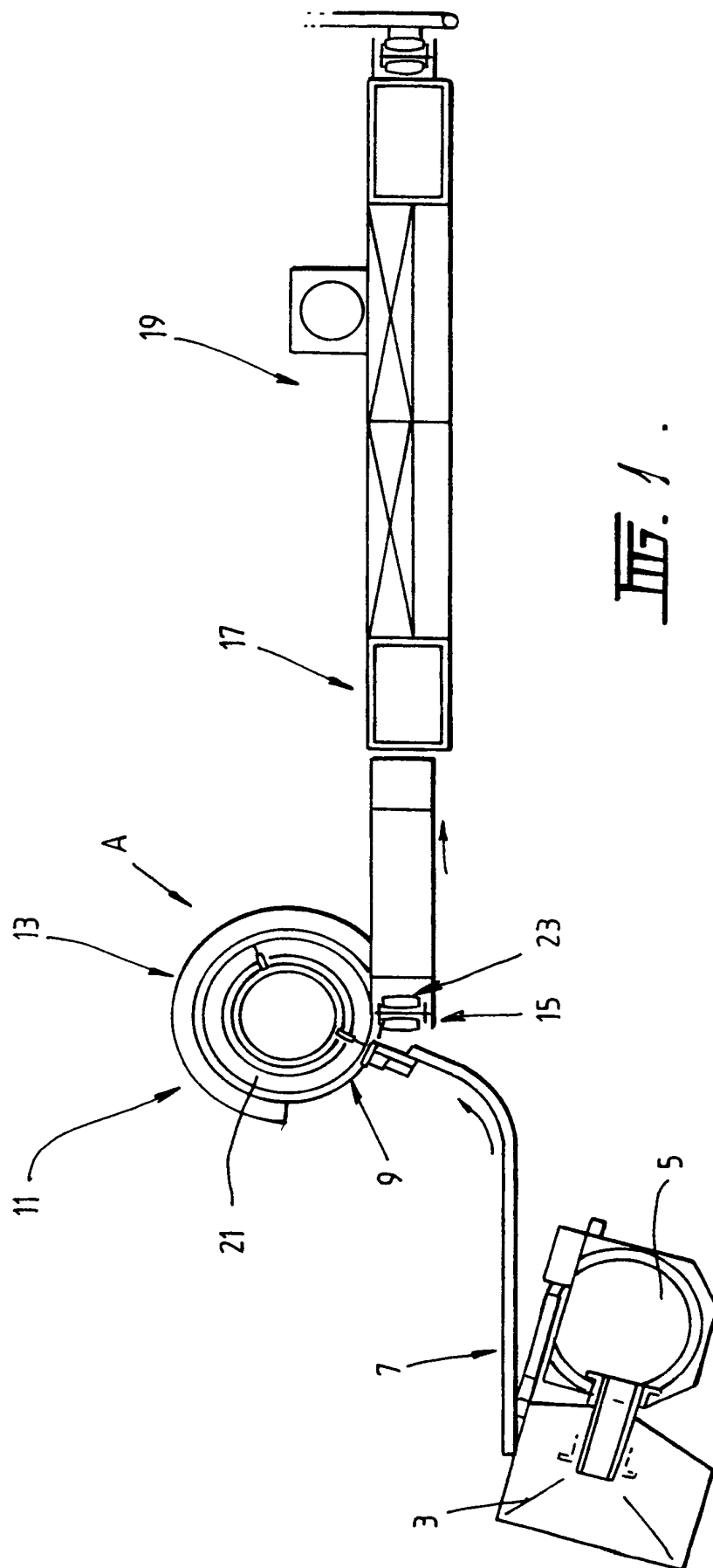
13. The apparatus defined in claim 12 wherein  
the support members are mounted to the turret so as to  
10 support bottles to move in a circular path.

14. The apparatus defined in claim 13 wherein  
the support members are adapted to support the bottles  
horizontally.

15  
15. The apparatus defined in any one of the  
preceding claims wherein each support member includes a  
spindle that is rotatable about its axis and a collet for  
retaining a bottle to the support member in a horizontal  
20 position.

16. The apparatus defined in any one of the  
preceding claims further includes a curing oven for curing  
coated bottles.

25  
17. The apparatus defined in claim 16 further  
includes transfer means for detaching coated bottles from  
the support members at the out-feed station and for  
transferring the coated bottles to the curing oven.



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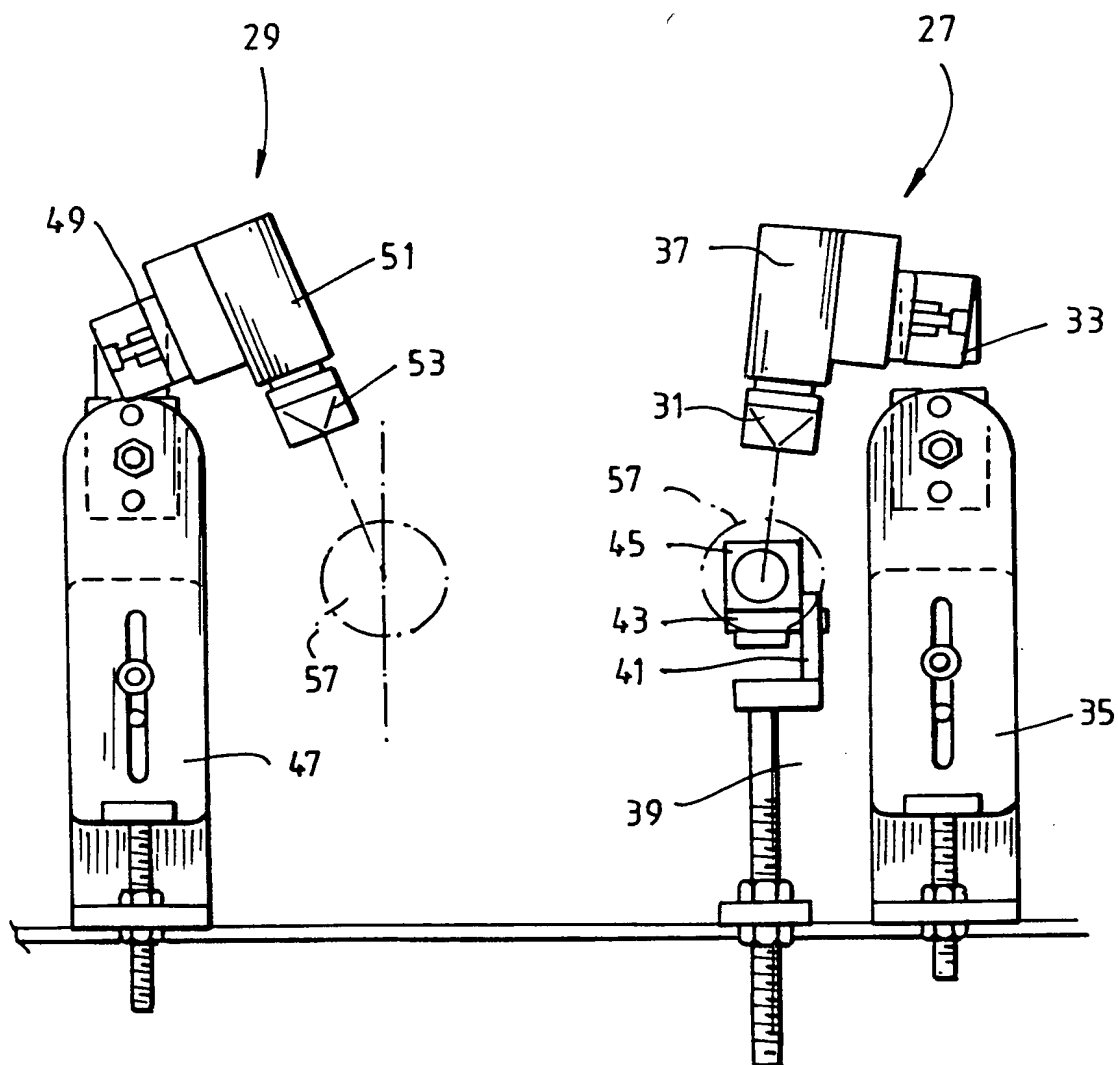


Fig. 2.

Fig. 3.

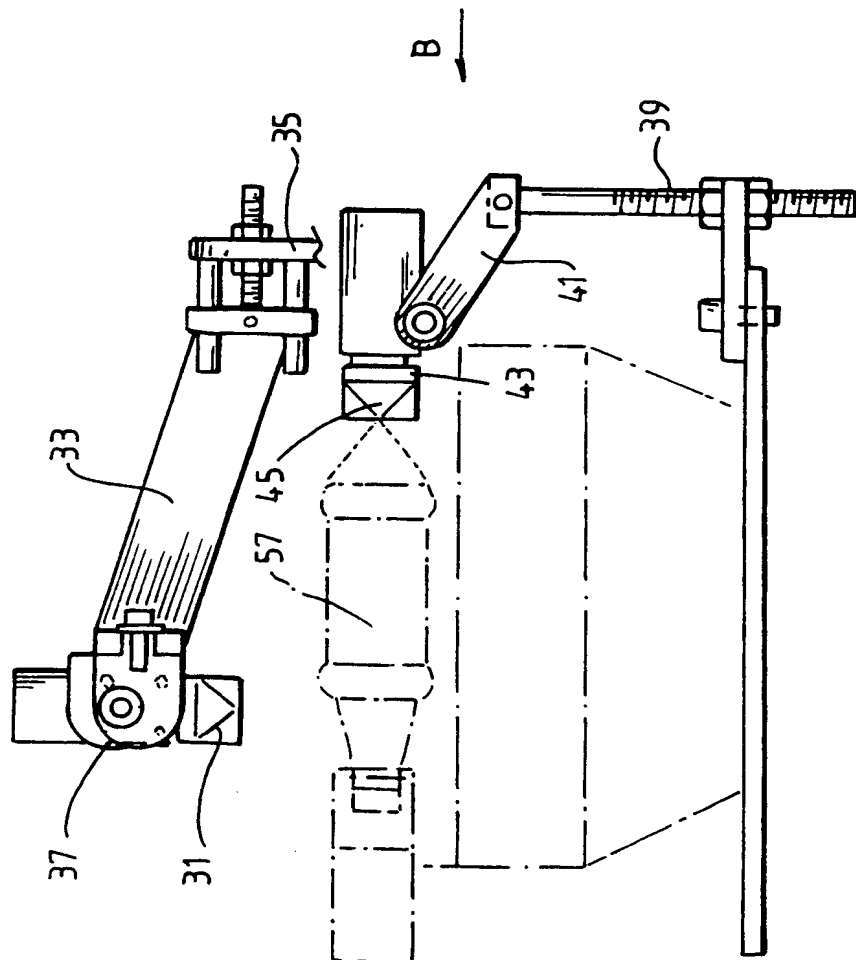
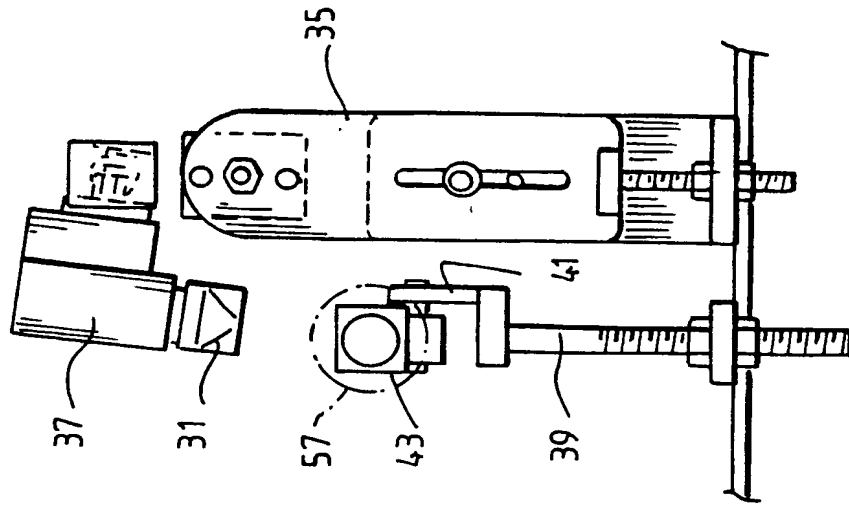
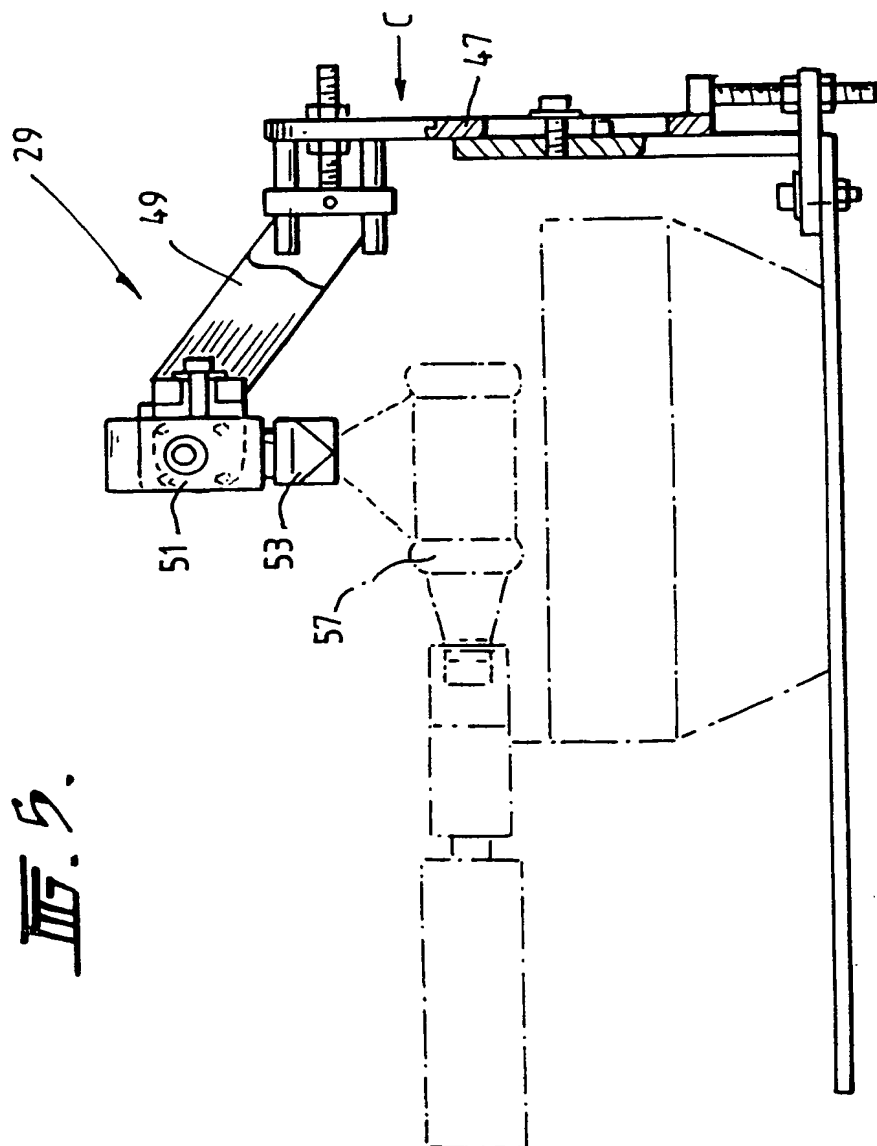
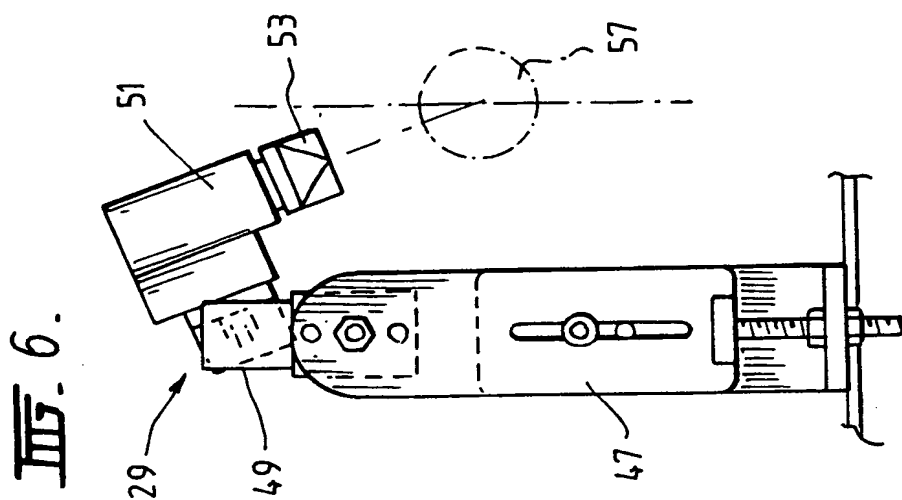


Fig. 4.





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## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/AU 99/00498****A. CLASSIFICATION OF SUBJECT MATTER**Int Cl<sup>6</sup>: B05D 1/02, B05B 13/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**Minimum documentation searched (classification system followed by classification symbols)  
B05B, B05C, B05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
WPAT, keywords**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5114525 A (DUBUIT) 19 May 1992 Whole document	1 - 17
X	DE 2520741 A (TOYO INK MFG CO LTD) 27 November 1975 Whole document	1 - 17
X	GB 1477516 A (MITSUI SHIPBUILDING ENGG) 22 June 1977 Whole document	1 - 17

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 99/00498

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0142583 A (KYOWA DENKI KAGAKU KK) 29 May 1985 Whole document	1 - 17
X	US 3951101 A (KARAKAWA ET AL) 20 April 1976 Whole document	1 - 17
X	WO 82/00137 A (VEBA-GLAS AG) 21 January 1982 Whole document	1 - 17

# **INTERNATIONAL SEARCH REPORT** **Information on patent family members**

International application No.  
**PCT/AU 99/00498**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	5114525	ES	2027552	FR	2656238	GB	2241948
DE	2520741	AU	81060/75	CA	1062095	FR	2270954
		GB	1504337	JP	51-106144		
GB	1477516	DE	2430990	FR	2235053	GB	1477516
		IT	1015399	JP	50-022840		
EP	0142583	NIL					
US	3951101	DE	2450899	FR	2248882	GB	1487252
		IT	1030735	JP	50-071731		
WO	82/00137	DE	3024564	EP	43077		
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